

THE COMMISSIONER OF PATENTS AND TRADEMARKS, Washington, D.C. 20231

Enclosed for filing is the patent application of Inventor(s):  
ANTONIUS A.C.M. KALKER and JAAP A. HAITMA

For: DETECTION OF A WATERMARK IN A COMPRESSED VIDEO SIGNAL

**ENCLOSED ARE:**

- [X] Appointment of Associates;
- [X] Information Disclosure Statement, Form PTO-1449 and copies of documents listed therein;
- [X] Preliminary Amendment;
- [X] Specification (8 Pages of Specification, Claims, & Abstract);
- [X] Declaration and Power of Attorney:  
(1 Page of a [X]fully executed [ ]unsigned Declaration);
- [X] Drawing (1 sheet of [ ]informal [X]formal sheets);
- [X] Certified copy of EUROPEAN application Serial No. 98202373.1;
- [X] Authorization Pursuant to 37 CFR §1.136(a)(3)
- [ ] Other:
- [X] Assignment to U.S. PHILIPS CORPORATION.

**FEE COMPUTATION**

CLAIMS AS FILED				
FOR	NUMBER FILED	NUMBER EXTRA	RATE	BASIC FEE - \$760.00
Total Claims	6 - 20 =	0	X \$18 =	0.00
Independent Claims	4 - 3 =	1	X \$78 =	78.00
Multiple Dependent Claims, if any			\$260 =	0.00
TOTAL FILING FEE . . . . .			=	\$838.00

Please charge Deposit Account No. 14-1270 in the amount of the total filing fee indicated above, plus any deficiencies. The Commissioner is also hereby authorized to charge any other fees which may be required, except the issue fee, or credit any overpayment to Account No. 14-1270.

[ ]Amend the specification by inserting before the first line as a centered heading --Cross Reference to Related Applications--; and insert below that as a new paragraph --This is a continuation-in-part of application Serial No. , filed , which is herein incorporated by reference--.

**CERTIFICATE OF EXPRESS MAILING**

Express Mail Mailing Label No. EL 2150054444  
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I hereby certify that this paper and/or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 C.F.R. 1.10 on the date indicated above and is addressed to the Commissioner of Patents and Trademarks, Washington, D.C. 20231.

Typed Name Valerie Deas Signature Valerie Deas

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10515 U.S. PTO  
09/348891  
07/06/99

66/06/99  
10575 U.S. PTO

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of

Atty. Docket

ANTONIUS A.C.M. KALKER ET AL.

PHN 17,025

SERIAL NO.:

GROUP ART UNIT:

FILED: CONCURRENTLY

EXAMINER:

DETECTION OF A WATERMARK IN A COMPRESSED VIDEO SIGNAL

Honorable Commissioner of Patents and Trademarks  
Washington, D.C. 20231

Sir:

PRELIMINARY AMENDMENT

Prior to calculating the filing fee and examination,  
please amend the above-identified application as follows:

IN THE SPECIFICATION

Page 1, before line 1, insert as a centered heading

--BACKGROUND OF THE INVENTION--;

line 1, delete in its entirety, and insert at the left  
margin --Field Of The Invention--;

line 7, delete in its entirety, and insert at the left  
margin --Description Of The Related Art--;

line 9, after "contents" insert --,-- (comma);

line 10, after "applications" insert --,-- (comma);

line 16, after "as" insert --a--;

line 27, change "WO-A-98/03014." to --WO-A-98/03014,  
corresponding to U.S. Patent Application Serial  
No. 08/895,250, filed July 16, 1997.--;

line 28, change "The invention" to --This watermark  
detector--;

Page 2, line 4, change "variable-lengthen coded" to  
--variable-length encoded--;

line 15, change "be copied or not," to --or may not be  
copied--;

line 33, after "i.e." insert --,-- (comma);

Page 3, line 1, change "MPEG encoded" to --MPEG-encoded--;

lines 4-6 and 8, change "bitrate" to --bit-rate--;

line 4, after "DVD" insert --,-- (comma);

line 14, after "found" insert --,-- (comma);

line 15, after "verified" insert --,-- (comma);

line 17, after "B-pictures" insert --,-- (comma);

line 18, change "full size" to --full-size--;

line 19, after "memories" insert --,-- (comma);

line 21, center the heading;

line 22, change "schematically" to --, schematically,--;

line 23, change "invention." to --invention;--;

line 25, change "1." to --1; and--;

line 29, delete in its entirety, and insert as a centered heading

--DESCRIPTION OF THE PREFERRED EMBODIMENTS--;

line 30, change "schematically" to --, schematically,--;

Page 4, line 1, change "international patent application" to

--International Patent Application--;

lines 10, 14 and 19, after "i.e." insert --,-- (comma);

line 28, after "(e.g." insert --,-- (comma).

#### IN THE ABSTRACT

Page 8, before line 1, delete in its entirety, and insert as a centered heading

--ABSTRACT OF THE DISCLOSURE--;

line 2, change "are disclosed. A" to --, in which a--;

line 3, delete "In";

line 4, change "accordance with the invention, a" to

--A--;

after line 7, delete in its entirety.

#### IN THE CLAIMS

Page 6, before claim 1, change "CLAIMS:" to

--WHAT IS CLAIMED IS:--.

Please amend the claims as follows:

1. (Amended) A method of detecting a watermark in a compressed video signal comprising spectral coefficients obtained by transforming pictures of said video signal, [characterized in that] the method [comprises] comprising the steps [of]:

5 [-] accumulating spatially corresponding coefficients of a plurality of pictures;

[-] inverse transforming said accumulated coefficients into an accumulated plurality of pictures; and

[-] detecting the watermark in said accumulated plurality of pictures.

2. (Amended) [A] The method as claimed in claim 1, wherein said encoded video signal includes predictively encoded pictures each comprising coefficients representing a residual picture after subtracting a prediction picture, and wherein the step of accumulating coefficients [being] is applied to the coefficients representing said residual pictures irrespective of coefficients representing the prediction picture.

3. (Amended) [A] The method as claimed in claim 2, wherein said predictively encoded pictures further include motion vectors, and wherein the step of accumulating coefficients [being] is carried out irrespective of said motion vectors.

4. (Amended) An arrangement for detecting a watermark in a compressed video signal comprising spectral coefficients obtained by transforming pictures of said video signal, [characterized in that] the arrangement [comprises] comprising:

5 [-] means [(2,3,4)] for accumulating spatially corresponding coefficients of a plurality of pictures;

[-] means [(5)] for inverse transforming said accumulated coefficients into an accumulated plurality of pictures; and

[-] means [(6)] for detecting the watermark in said accumulated plurality of pictures.

5. (Amended) An arrangement for decoding a compressed video signal comprising spectral coefficients obtained by transforming pictures of said video signal, [characterized in that] the arrangement [comprises] comprising:

[-] means [(2,3,4)] for accumulating spatially corresponding coefficients of a plurality of pictures; and

[-] means [(5)] for inverse transforming said accumulated coefficients into an accumulated plurality of pictures.

6. (Amended) A device for recording and/or playing back a compressed video signal, said device comprising means [(32)] for disabling recording and/or playback of the video signal in

dependence upon the presence of a watermark in said video signal,  
5 characterized in that the device comprises an arrangement [(36) as  
claimed in claim 4] for detecting said watermark in the video  
signal, said arrangement comprising:

means for accumulating spatially corresponding  
coefficients of a plurality of pictures;

10 means for inverse transforming said accumulated  
coefficients into an accumulated plurality of pictures; and

means for detecting the watermark in said accumulated  
plurality of pictures.

REMARKS

The specification has been amended in various places to correct typographical and grammatical errors.

The claims have been amended to more clearly define the invention as disclosed in the written description. In particular, the claims have been amended for clarity.

When the Examiner takes this case up for examination, it is respectfully requested that this Preliminary Amendment be taken into consideration.

Respectfully submitted,

by 

Edward W. Goodman, Reg. 28,613

Attorney

Tel.: 914-333-9611



Detection of a watermark in a compressed video signal.

## FIELD OF THE INVENTION

The invention relates to a method and arrangement for detecting a watermark in a compressed video signal. The invention also relates to an arrangement for decoding a compressed video signal so as to obtain a signal which is suitable for watermark  
5 detection.

## BACKGROUND OF THE INVENTION

Watermarking is a technique of embedding imperceptible information in multimedia contents such as audio, still images or moving video. Watermarks are used for  
10 applications such as ownership verification, copyright protection and copy and playback control.

A watermark is often embedded in a video signal by slightly modifying the luminance pixels of the video signal in accordance with a watermark pattern. For the purpose of understanding this invention, it suffices to imagine the watermark pattern as an  
15 array of +1 and -1 values which is added to an equally sized array of pixels. The array of pixels having the same size as the watermark pattern is hereinafter referred to as "picture". A picture may be a full-size video image (480\*720 pixels for NTSC or 576\*720 pixels for PAL) or a part thereof, for example, a sub-image of 128\*128 pixels. If the watermark pattern is smaller than the image, it is known as a "tile". The pattern is then repeatedly used to obtain a  
20 "tiled" image. It is assumed that a plurality of pictures is watermarked with the same watermark pattern.

Detection of a watermark in a picture is, in essence, a thresholded correlation operation. A watermark detector decides whether or not a suspect picture is watermarked by computing the amount of correlation between the suspect picture and the  
25 watermark pattern to be detected, and comparing the result with a predetermined threshold. An example of such a watermark detector is disclosed in Applicant's International Patent Application WO-A-98/03014.

The invention addresses the problem of detecting a watermark in a compressed video signal. Video compression reduces the amount of data to be transmitted or

recorded. A well-known example is MPEG compression. Briefly summarized, MPEG compression includes discrete cosine transform (DCT) of blocks of pixel values into blocks of coefficients. The coefficients are quantized, which causes many coefficients to assume the value zero. The quantized coefficients are variable-length coded by assigning a Huffman codeword to each run of zero coefficients and a subsequent non-zero coefficient. The pictures can be encoded autonomously (I-pictures), or predictively (P- and B-pictures). In the latter case, residual pixel blocks (which are left after subtracting motion-compensated prediction blocks) are transformed rather than the pixel blocks themselves.

A straightforward method of detecting the watermark employs a cascade arrangement of a conventional MPEG decoder and a conventional watermark detector. However, it has a total complexity which is too large to serve as a viable solution for mere watermark detection because MPEG decoding is a costly operation in terms of numbers of operations, complexity and amount of memory. This is particularly true for a DVD drive which is envisaged to include a watermark detector so as to determine whether a video program may be copied or not, but does not itself include an MPEG decoder.

#### OBJECT AND SUMMARY OF THE INVENTION

It is an object of the invention to provide a cost-effective method of detecting a watermark in a compressed video signal.

To this end, the method in accordance with the invention comprises the steps of accumulating spatially corresponding coefficients of a plurality of pictures, inverse transforming said accumulated coefficients into an accumulated plurality of pictures, and detecting the watermark in said accumulated plurality of pictures.

The invention is based on the recognition that a watermark embedded in a plurality of pictures is more reliably detected if said plurality of pictures is first accumulated and the watermark detection is then carried out on the result of said accumulation. The invention further exploits the insight that (inverse) transformation and accumulation are commutative operations which may be carried out in a reversed order.

The method has significant advantages over the straightforward method of first conventionally decoding the video signal and then detecting the watermark in the decoded signal. The number of inverse transform operations per unit of time is considerably reduced. Instead of inverse transforming each individual block of coefficients, the inverse transform is not carried out until a plurality of pictures has been accumulated, i.e. once per watermark detection period. Another advantage of the invention follows from the

consideration that the coefficients of an MPEG encoded video signal are variable-length encoded and that the number of bits per picture largely depends on whether the picture is an I-, P- or B-picture. In view thereof, a conventional MPEG decoder includes a large input buffer for converting the nearly constant bitrate of the MPEG bitstream (for DVD of the order of 10 Mbit/s) into a heavily varying bitrate with maxima up to 40 Mbit/s, and the variable-length decoder must be capable of processing the highest instantaneous bitrate. By interchanging the order of inverse transform and accumulation, the variable-length decoding can be carried out at the input bitrate. The variable-length decoder is considerably simplified and the large input buffer can be dispensed with. Further, the buffer for accumulating the coefficients has the size of the watermark pattern. For detecting a watermark in "tiled" images, such a buffer is considerably smaller than the full-size image buffer of a conventional MPEG decoder.

It has been found that the watermark is sufficiently present in residual pixel blocks. In view thereof, it is not necessary to reconstruct P- and B-pictures. The coefficients of these pictures may be accumulated directly. It has also been found and experimentally verified that motion compensation can be omitted for the purpose of watermark detection. The accumulation of coefficients may be carried out irrespective of motion vectors included in the signal. Circuitry for reconstructing P-and B-pictures such as a variable-length decoder for decoding motion vectors, a motion compensator, and two full size frame memories can thus be dispensed with.

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#### BRIEF DESCRIPTION OF THE DRAWING

Fig. 1 shows schematically an arrangement for detecting a watermark in accordance with the invention.

Fig. 2 shows a diagram to illustrate the operation of the arrangement which is shown in Fig. 1.

Fig. 3 shows a DVD drive including the arrangement which is shown in Fig. 1.

#### DESCRIPTION OF AN EMBODIMENT

Fig. 1 shows schematically an arrangement for detecting a watermark in accordance with the invention. The arrangement comprises a variable-length decoder 1, an accumulator 2, a buffer 3, an address generator 4, an inverse discrete cosine transformer 5 and a watermark detection circuit 6. The watermark detection circuit 6 is a conventional

30

watermark detector as disclosed, for example, in international patent application WO-A-98/03014.

The arrangement receives a compressed video signal in the form of an MPEG bitstream MP. The majority of the payload of the MPEG bitstream includes variable-length coded coefficients and motion vectors. In accordance with an aspect of the invention, the motion vectors are ignored. The codewords representing coefficients are decoded by the variable-length decoder 1. Many coefficients have the value zero. A single codeword represents a run of zero coefficients and a subsequent non-zero coefficient. A special codeword denotes the end of a block. For each coefficient, the variable-length decoder 1 generates the coefficient value C and its ordinal number n, i.e. its relative position in the block of 8\*8 coefficients.

The spatially corresponding coefficients of a plurality of pictures are accumulated in an accumulation buffer 3. It is here assumed that the picture size (and thus the buffer size) is 128\*128 pixels, i.e. an integral number of DCT blocks. The buffer 3 is addressed by an address generator 4 which keeps count of the position of the current DCT block within the picture and receives the ordinal coefficient number n from the variable-length decoder 1. The accumulator 2 adds the current coefficient value C to the result accumulated thus far. It is noted that, in accordance with one aspect of the invention, the coefficients are accumulated irrespective of whether they represent pixels or residual pixels, i.e. whether they originate from autonomously encoded I-pictures or predictively encoded P- or B-pictures.

The above described operational steps are illustrated in Fig. 2. In this Figure, reference numeral 9 represents a full-size tiled image in the transform domain. The image has been watermarked by repeatedly adding a watermark pattern to (sub)pictures 91-99 having a size of 128\*128 pixels. As shown on the right-hand side of the Figure, the pictures 91-99 are folded and accumulated so that an accumulated picture 100 is obtained (still in the transform domain).

After accumulating the coefficients of a predetermined number of pictures (e.g. all pictures forming a full-size tiled image and/or a plurality of images), the accumulated result is applied to the DCT circuit 5 in which it is inverse transformed into the spatial domain. The accumulated spatial "picture" P is then applied to the conventional watermark detection circuit 6.

Fig. 3 shows a DVD drive for playing back an MPEG bitstream which is recorded on a disc 31. The recorded signal is applied to an output terminal 33 via a switch 32. The output terminal is connected to an external MPEG decoder and display device (not

shown). It is assumed that the DVD drive may not play back video signals with a predetermined embedded watermark, unless other conditions, which are not relevant to the invention, are fulfilled. For example, watermarked signals may only be played back if the disc 31 includes a given "wobble" key. In order to detect the watermark, the DVD drive comprises a watermark detector 34 as described above with reference to Fig. 1. The watermark detector 34 receives the recorded signal and controls the switch 32 in response to whether or not the watermark is detected.

In summary, a method and arrangement for detecting a watermark embedded in an MPEG compressed signal are disclosed. A conventional MPEG decoder is stripped to such an extent that a modified baseband video signal suitable for watermark detection is obtained. In accordance with the invention, a plurality of pictures with the embedded watermark is accumulated in the transform domain, and the inverse DCT is applied to the accumulated result. Conventional watermark detection is then applied to the accumulated plurality of pictures in the spatial domain.

## CLAIMS:

1. A method of detecting a watermark in a compressed video signal comprising spectral coefficients obtained by transforming pictures of said video signal, characterized in that the method comprises the steps of:

- accumulating spatially corresponding coefficients of a plurality of pictures;
- 5 – inverse transforming said accumulated coefficients into an accumulated plurality of pictures; and
- detecting the watermark in said accumulated plurality of pictures.

2. A method as claimed in claim 1, wherein said encoded video signal  
10 includes predictively encoded pictures each comprising coefficients representing a residual picture after subtracting a prediction picture, the step of accumulating coefficients being applied to the coefficients representing said residual pictures irrespective of coefficients representing the prediction picture.

15 3. A method as claimed in claim 2, wherein said predictively encoded pictures further include motion vectors, the step of accumulating coefficients being carried out irrespective of said motion vectors.

4. An arrangement for detecting a watermark in a compressed video  
20 signal comprising spectral coefficients obtained by transforming pictures of said video signal, characterized in that the arrangement comprises:

- means (2,3,4) for accumulating spatially corresponding coefficients of a plurality of pictures;
- means (5) for inverse transforming said accumulated coefficients into an accumulated  
25 plurality of pictures; and
- means (6) for detecting the watermark in said accumulated plurality of pictures.

5. An arrangement for decoding a compressed video signal comprising spectral coefficients obtained by transforming pictures of said video signal, characterized in that the arrangement comprises:

- means (2,3,4) for accumulating spatially corresponding coefficients of a plurality of pictures; and
- means (5) for inverse transforming said accumulated coefficients into an accumulated plurality of pictures.

6. A device for recording and/or playing back a compressed video signal, comprising means (32) for disabling recording and/or playback of the video signal in dependence upon the presence of a watermark in said video signal, characterized in that the device comprises an arrangement (36) as claimed in claim 4 for detecting said watermark in the video signal.

## ABSTRACT:

A method and arrangement for detecting a watermark embedded in an MPEG compressed signal are disclosed. A conventional MPEG decoder is stripped to such an extent that a modified baseband video signal suitable for watermark detection is obtained. In accordance with the invention, a plurality of pictures with the embedded watermark is

5 accumulated (2,3,4) in the transform domain, and the inverse DCT (5) is applied to the accumulated result. Conventional watermark detection (6) is then applied to the accumulated plurality of pictures in the spatial domain.

Fig. 1.



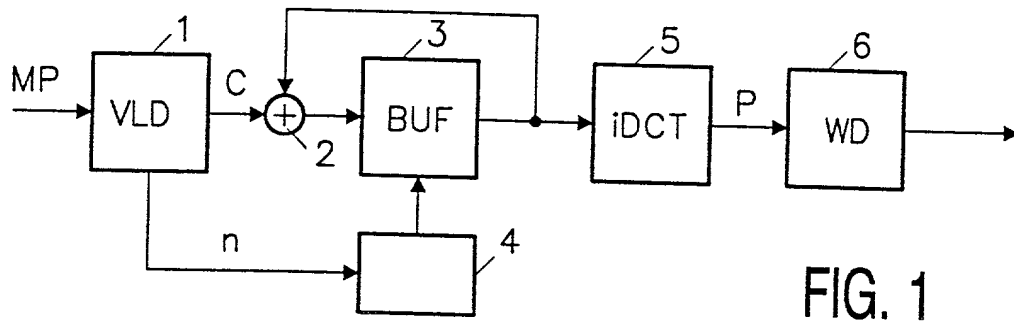


FIG. 1

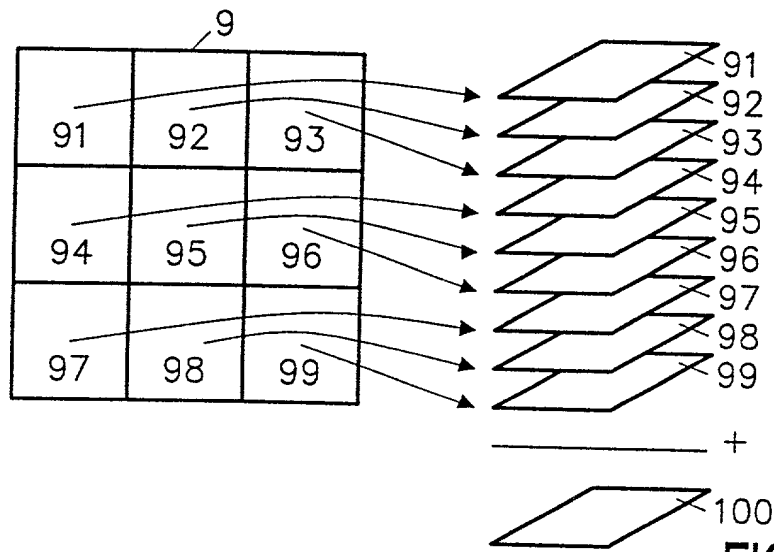


FIG. 2

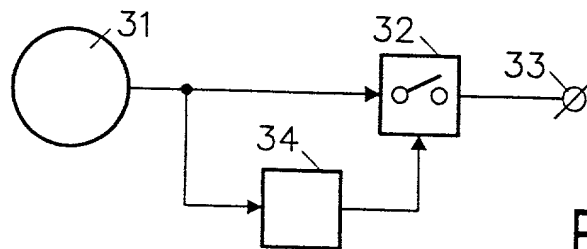


FIG. 3

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of

Atty. Docket

ANTONIUS A.C.M. KALKER et al.

PHN 17,025

Serial No.

Group Art Unit

Filed: CONCURRENTLY

Examiner:

Title: DETECTION OF A WATERMARK IN A COMPRESSED VIDEO SIGNAL

Honorable Commissioner of Patents and Trademarks  
Washington, D.C. 20231

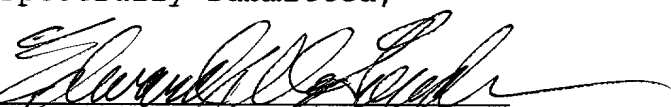
AUTHORIZATION PURSUANT TO 37 CFR §1.136(a)(3)  
AND TO CHARGE DEPOSIT ACCOUNT

Sir:

The Commissioner is hereby requested and authorized to treat any concurrent or future reply in this application requiring a petition for extension of time for its timely submission, as incorporating a petition for extension of time for the appropriate length of time.

Please charge any additional fees which may now or in the future be required in this application, including extension of time fees, but excluding the issue fee unless explicitly requested to do so, and credit any overpayment, to Deposit Account No. 14-1270.

Respectfully submitted,

By   
Edward W. Goodman, Reg. 28,613  
Attorney  
(914) 333-9611

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# DECLARATION and POWER OF ATTORNEY

ATTORNEY'S DOCKET NO.:  
PHN 17.025

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled **"Detection of a watermark in a compressed video signal"** the specification of which (check one)

☒ is attached hereto.

☐ was filed on \_\_\_\_\_ as Application Serial No. \_\_\_\_\_ and was amended on \_\_\_\_\_ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by the amendment(s) referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, § 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

## PRIOR FOREIGN APPLICATION(S)

COUNTRY	APP. NUMBER	DATE OF FILING (DATE, MONTH, YEAR)	PRIORITY CLAIMED UNDER 35 U.S.C. 119
Europe	98202373.1	15 July 1998	YES

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35 United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

## PRIOR UNITED STATES APPLICATION(S)

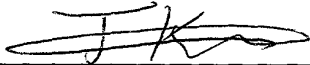

APPLICATION SERIAL NUMBER	FILING DATE	STATUS (PATENTED, PENDING, ABANDONED)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

**POWER OF ATTORNEY:** As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (list name and registration number)

Algy Tamoshunas, Reg. No. 27,677

Jack E. Haken, Reg. No. 26,902

SEND CORRESPONDENCE TO: Corporate Patent Counsel; U.S. Philips Corporation; 580 White Plains Road; Tarrytown, NY 10591		DIRECT TELEPHONE CALLS TO: (name and telephone No.) (914) 332-0222	
Dated: June 1, 1999		Inventor's Signature: 	
Full Name of Inventor	Last Name <b>KALKER</b>	First Name <b>Antonius</b>	Middle Name <b>A.C.M.</b>
Residence & Citizenship	City <b>Eindhoven</b>	State or Foreign Country <b>The Netherlands</b>	Country of Citizenship <b>The Netherlands</b>
Post Office Address	Street <b>Prof. Holstlaan 6</b>	City <b>5656 AA Eindhoven</b>	State or Country <b>The Netherlands</b> Zip Code
Dated: June 4, 1999		Inventor's Signature: 	
Full Name of Inventor	Last Name <b>HAITSMA</b>	First Name <b>Jaap</b>	Middle Name <b>A.</b>
Residence & Citizenship	City <b>Eindhoven</b>	State or Foreign Country <b>The Netherlands</b>	Country of Citizenship <b>The Netherlands</b>
Post Office Address	Street <b>Prof. Holstlaan 6</b>	City <b>5656 AA Eindhoven</b>	State or Country <b>The Netherlands</b> Zip Code

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of  
ANTONIUS A.C.M. KALKER et al.

Atty. Docket  
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Filed: CONCURRENTLY

Examiner:

Title: DETECTION OF A WATERMARK IN A COMPRESSED VIDEO SIGNAL

Honorable Commissioner of Patents and Trademarks  
Washington, D.C. 20231

APPOINTMENT OF ASSOCIATES

Sir:

The undersigned Attorney of Record hereby revokes all prior appointments (if any) of Associate Attorney(s) or Agent(s) in the above-captioned case and appoints:

**EDWARD W. GOODMAN**

**(Registration No. 28,613)**

c/o U.S. PHILIPS CORPORATION, Intellectual Property Department, 580 White Plains Road, Tarrytown, New York 10591, his Associate Attorney(s)/Agent(s) with all the usual powers to prosecute the above-identified application and any division or continuation thereof, to make alterations and amendments therein, and to transact all business in the Patent and Trademark Office connected therewith.

ALL CORRESPONDENCE CONCERNING THIS APPLICATION AND THE LETTERS PATENT WHEN GRANTED SHOULD BE ADDRESSED TO THE UNDERSIGNED ATTORNEY OF RECORD.

Respectfully,



Algy Tamoshunas, Reg. 27,677  
Attorney of Record

Dated at Tarrytown, New York  
this 21<sup>ST</sup> day of June, 1999.